of feathers in the hind part of the back, which are pointed like spines. The quills of the feathers are remarkably thick and hard, and taper suddenly to a fine point. They do not however terminate there, but continue a little further with a uniform thickness. This continuation however, is slender and so soft, that it gives not the least resistance to a slight pressure; whereas the hard part has the appearance of a pointed spine. This structure is identical in the African, Asiatic and Australian species, so that no geographical subdivision of the genus, such as some have attempted, can be made.

[To be continued.]

XIV.—*Remarks on some Points in the Structure of* Cucurbitaceæ. By J. E. Stocks, M.D., Assistant Surgeon on the Bombay Establishment.

Stem.—Examining the pentagonal stem of *Cucurbitaceæ* we find the disposition of its leaves to be the quincunx ($\frac{2}{5}$), and the angles to be chiefly formed by the main nerve of a leaf, which does not proceed from the nodus at which that leaf is situate, but is given off from the axil of the fifth leaf below, or in other words, the leaf which, on reducing the part to the state of bud, would be *immediately* below.

Numbering the leaves: the nerve from the axil of leaf 1 becomes the main nerve in the petiole of leaf 6, but previously two offsets are detached, one to the tendril side of leaf 3, which forms one of the side nerves of the petiole, previously supplying the tendril, and one to form one of the lateral nerves of the petiole of leaf 4 on that side which is destitute of tendril. Now 3 and 4 are the leaves immediately to the right and left of leaf 1, and the main nerve proceeding from their axils gives off the lateral nerves to the petiole of leaf 6, from one of which is detached a branch to the tendril. It may be deduced that each leaf consists of three parts, one adhering to the stem and forming a part of it, having elongated with its elongation, and widened together with it—the stem-clasping or stem-sheathing part; one the free part, including petiole and blade; and at the junction of these on each side a process or auricle called stipule, which, in *Cucurbitaceæ*, is cirrhose and exists on one side only.

The three-nerved sheath has its middle nerve readily traceable to the fifth leaf below, but its side nerves on the elongation of the stem unite for some distance with the main nerve of those leaves which are situate to the right and left of it. From one of these is given off the branch to the cirrhose stipule.

Stamens.—The perianthium has its leaves five in a whorl, the ovarial leaves are generally three. Hitherto the stamens have

been considered to agree in number with the former, four of them uniting by pairs and so leaving the odd one free; and this view is favoured by the occurrence of transitions from the complete union both of anther and filament through various stages to the complete independence of all the five members, such as exists in *Luffa pentandra even as to vascular bundles*. According to this view, each anther has a continuous, generally anfractuose loculus, with a median fissure following its curves, and a longitudinal septum (!) which must represent the connective or middle line of the anther, from which, on this supposition, the anther-valves in *Cucurbitaceæ* must separate. Moreover, on this view of the structure, the loculi of adjacent anthers are bent in opposite directions. But in *Coccinia indica* there are always six such serpentine loculi united by pairs, and in *Citrullus Colocynthis* and *vulgaris* there are as often six as five, the supplementary one frequently not quite so anfractuose as the others. It is by no means a necessary deduction that six is the normal, and five the reduced number of the staminal leaves.

The three-lobed, waxy, nectar-secreting disc so universally present in *Cucurbitaceæ* deserves attention; which in the female flower might be supposed to represent the stamens, were it not for the constant presence of anantherous filaments, whose situation and sometimes the anthers developed on them (*Citrullus*) point them out as the sterile stamens. In some this disc is adherent to the calyx, in others free; in this latter case it is perforated by the style in the female flower, but in the male forms a button in the centre of the flower—the abortive ovary of some. It is manifestly a degeneration of the same part in both male and female flowers, and from its constantly presenting three divisions we gather that it represents an inner whorl of three staminal leaves. In *Momordica Charantia* it sometimes developes a flat, coloured body bearing pollen on its edge.

Three ovarial leaves and three inner staminal leaves presuppose an outer whorl of three (not six) stamens. In *Cucurbitaceæ*, then, the inner whorl of stamens is indicated by a disc, and the number of its leaves by the divisions of that disc. The outer whorl is of three leaves, whose blade is abortive, and whose anther-cells are developed on the auricles of the sheath-part of the leaf, corresponding to the tendrils of the stem-leaves, or the stigma-points of the ovarial leaves. Each staminal leaf is of two parts as the stigma-points are two, and as the tendrils (stipules) are two; and as in the stem-leaves one tendril is suppressed, so also in the staminal leaves one of the six loculi is generally wanting, often imperfect, but in many cases developed equally with the others.

Thus are reconciled the occurrence of five or of six members

belonging evidently to a ternary whorl, their binary adhesion in some cases, their separation (even as to vascular bundles) in others, as also the opposite twisting of their loculi in contiguous members; whereas some or other of these particulars will stand in the way of other views.

Ovary.—The ovarial leaves are sometimes two (*Mukia, Pilogyne*), generally three.

In the three-leaved ovary we have three dissepiments proceeding from the parietes and three from the axis, which last bear the ovules on their parietal extremity.

These appearances are variously explained.

1. Dr. Lindley supposes a valvate æstivation of the carpellary leaves. According to this view, the dissepiments are spurious, three proceeding from the placentæ and the three intermediate ones from the midrib of the carpels.

2. According to Schleiden's views, the placental dissepiments must be regarded as prolongations of the axis, extending into the cavity formed by carpellary leaves with an induplicate æstivation. This opinion was long ago (1823) taken by St. Hilaire.

3. Dr. Wight supposes the carpellary leaves to have a reduplicate æstivation, and the cavity of the ovary to be completed on one side by the calyx. The intermediate or primary dissepiments would have to be regarded as spurious.

4. Arnott (Prodromus Fl. Pen. Ind. Orient.) and Endlicher (Gen. Plant.) describe the carpels of *Cucurbitaceæ* as involute.

The evidence afforded by dissection and by analogy proves the correctness of the last of these views.

1. In many *Cucurbitaceæ* whose corolla is conical in bud, the æstivation of the upper part of the corolla is beautifully involute, and presents a remarkable similitude to the young ovary: so that the bending of the carpellary leaves is not a forced explanation, but is just what happens in *Cucurbitaceæ* when the floral leaves meet in the axis.

2. In those Cucurbitaceous fruits whose vessels lignify and whose cells encrust, we can trace the leaf-skeleton following an involute course, and in none better than in many species of *Luffa*. Breaking off the outer shell (calyx) we come to a fibrous layer which runs externally chiefly round the fruit, and internally from top to bottom. This sends in processes at three points only (primary or barren dissepiments), which after meeting in the axis turn outwards into the cavity of the ovary and bear the seeds. In *Luffa pentandra*, just before hardening has commenced, on removing the operculum the primary or barren dissepiments are plainly seen to be composed of two layers when we examine them at the apex of the fruit where seeds are not developed, and less plainly below, owing to the pressure of the seeds which indent

the inflected sides of the carpels and lie imbedded each in their own cell.

3. In *Citrullus Colocynthis* and others, when we carefully dissect off the rind of the fruit, we find the placentæ forming a continuous line from the top to the bottom, perfectly free from any attachment to the rind or to the pulp, and splitting down the centre without force so as to divide each placental dissepiment into two.

It may be remarked that the three columns of pulp in *Coccinia indica*, which Dr. Wight regards as representing the carpellary leaves, are each divided into two other columns by a double line of vessels (the primary dissepiments) which can be traced following the usual involute direction and end in the placentæ.

Style and Stigma.—In the style the carpellary leaf has an induplicate æstivation, leaving in many cases a style-canal. The style-column diverges into its three parts, and each of these ends in two stigma-points which are connected by a crescentic line of stigmatic tissue looking outwards. The styles are opposite to the seminiferous, and alternate with the primary dissepiments; and the stigma-points when close together are immediately on each side of the secondary or seminiferous dissepiments; but when much diverging, those of adjacent carpels are close together and opposite the primary dissepiments.

Arillus.—A seed is said to have an arillus when the parenchyma in which it is imbedded becomes pulpy and adheres to its surface; but the term should be cancelled if we regard the origin of the part, for it does not grow from the placenta over the seed, but is merely the cellular tissue in which it nestles. In *Luffa* and *Citrullus* it is a mere scarious membrane which soon peels off; in *Coccinia, Momordica, Trichosanthes*, a red pulp; in *Pilogyne* a gelatinous nidus.

Examining *Coccinia* when half-ripe we find vascular parchment-cells, inside which are the seed and a waxy substance which afterwards becomes the soft arillus, while the parchment-layer with its vessels becomes flexible and offers no resistance to the separation of the seeds. In *Luffa*, the layer to which the vessels are more immediately attached remains dry and membranous in the lignified pepo, and it is chiefly the epidermis of the carpellary leaf which becomes the filmy fugacious covering of the seed.

In *Trichosanthes* again the pulp breaks up, and a portion adheres to each seed, in which we can trace the vascular layer of the carpellary leaf, and internal to it the pulpy layer, and more internal still a thin membrane, which we may regard as the epidermis or that part which is seen covering the seed of *Luffa*.